[JP,10-121913,A(1998)]

Claim(s)]

[Claim 1]A compression equipment installed in a low meniscus point gas supply plant interposing and forming in a channel of compressed gas a heat exchanger which cools the above-mentioned compressed gas using cold energy produced at the time of evaporation of a low temperature liquefied gas.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the compression equipment installed in the low meniscus point gas supply plant which makes a low temperature liquefied gas, for example, LNG, i.e., liquefied natural gas, evaporate, and sends out natural gas.

[0002]

[Description of the Prior Art]Conventionally, what is shown in drawing 5 as a supply plant of this kind of gas is publicly known. In this supply plant, LNG in LNG tank 1 is led to the evaporator 3 with the pump 2, and LNG is made to evaporate here, it changes into the state of NG, i.e., natural gas, and this drives the expansion turbine 4. And while driving and generating the dynamo 5 by rotating a turbine, temperature up of the natural gas is carried out by expanding and carrying out heat exchange of the natural gas which carried out the temperature fall, and the sea water supplied from the sea water supply equipment 6 with the heat exchanger 7. In addition, JP,S58-73905,U has a thing of an indication to use sea water in a supply plant of the same kind.

[0003]On the other hand, it is general to have instrumentation equipments, i.e., a compression equipment, as shown, for example in drawing 6 in the LNG supply plant mentioned above. In this drawing 6, the example of the two-step type compression equipment which drives the compressors 9 and 10 by the motor 8 is shown, and the heat exchanger 14 for cooling compressed gas on the intermediate-flow way 13 between the discharge mouth 11 of the compressor 9 and the inlet port 12 of the compressor 10 is **(ed). And the channel 17 for cooling containing the cooling system 15, the pump 16, and the heat exchanger 14 is made to circulate through a cooling medium, and heat is taken from the above-mentioned compressed gas by this cooling medium with the heat exchanger 14.

[0004]

[Problem to be solved by the invention]In the above-mentioned conventional LNG supply plant, sea water supply equipment was required to carry out temperature up of the dynamo 5 and the natural gas, and also there was a problem that the motor 8 and the cooling system 15 were required as an object for instrumentation equipments provided aside from this plant, and equipment became complicated. This invention tends to provide the compression equipment installed in the low meniscus point gas supply plant which was made considering losing the problem

of the **** former as SUBJECT, and consists of simpler composition.
[0005]
[Means for solving problem]In order to solve above-mentioned SUBJECT, this invention interposed and formed in the channel of compressed gas the heat exchanger which cools the above-mentioned compressed gas using the cold energy produced at the time of evaporation of a low temperature liquefied gas.
[0006]
[Mode for carrying out the invention]Next, one form of operation of this invention is explained according to Drawings. About the same portion as the equipment which shows the two-step type compression equipment 21 concerning a 1st embodiment of this invention, and is shown in drawing 5, drawing 1 attaches the same number mutually and omits explanation. This compression equipment 21 equips the intermediate-flow way 26 between the inlet ports 25 of the compressor 24 of the 2nd step with the heat exchanger 27 from the discharge mouth 23 of the compressor 22 of the 1st step. The compressors 22 and 24 are driven by the expansion turbine 4. The discharged gas which carried out the temperature drop from the expansion turbine 4 is led to the heat exchanger 27, After carrying out heat exchange between the compressed gas which it was compressed with the compressor 22 here and carried out the rise in heat, and carrying out temperature up, while being sent out from the heat exchanger 27, after being cooled, the above-mentioned compressed gas is further compressed by the compressor 24, and is sent out.
[0007]Thus, in this equipment, like [at the time of forming the compression equipment shown in the LNG supply plant and drawing 6 which are shown in drawing 5], a dynamo, sea water supply equipment, a motor, and a cooling system are not needed, but it has simple composition. This equipment can be installed also in the reason which does not need sea water, and the inland distant from the sea. Although this 1st embodiment showed the example using LNG gas, this invention is not limited to this and also contains the compression equipment using the low temperature liquefied gas replaced with this. Although this 1st embodiment explained the example which uses the expansion turbine 4, this invention is not limited to this, is replaced with the expansion turbine 4, and also contains the compression equipment using an axial flow compressor or a screw compressor. The same can be said for the compression equipment applied to each embodiment described below about these points.
[0008]In drawing 1, as a two-dot chain line shows, the induction generator 28 may be added to an end of a revolving shaft of the expansion turbine 4 which drives the compression equipment 21. And by constituting in this way, it becomes possible, and stabilizing an engine speed of a turbine also at the time of load change is stabilized, and it can supply compressed gas now. While being able to stabilize the above-mentioned engine speed further by adding the induction generator 28, when rotation power of the expansion turbine 4 becomes large, a generation of electrical energy becomes possible. Drawing 2 shows the compression equipment 31 concerning a 2nd embodiment of this invention, this compression equipment 31 is replaced with composition in the frame II of a dashed dotted line which shows drawing 2 composition in the frame I of a dashed

dotted line shown in drawing 1, and other composition is substantially [as what is shown in drawing 1] the same. In drawing 2, the same number is mutually attached about a portion shown in drawing 1, and a common portion.
[0009]This compression equipment 31 equips the discharge passage 33 linked to the discharge mouth 32 of the compressor 24 with the flow control valve 34 and the heat exchanger 35 while having the heat exchanger 27 on the intermediate-flow way 26 between the compressor 22 of the 1st step, and the compressor 24 of the 2nd step. The natural gas which came out of the heat exchanger 27 to this heat exchanger 35 passes, and heat exchange is possible like the above between this natural gas and the compressed gas in the discharge passage 33. It branches from the portion of the discharge passage 33 between the discharge mouth 32 and the flow control valve 34, The bypass passage 37 which joins the portion of the discharge passage 33 of the secondary of the heat exchanger 35 is formed through the flow control valve 36, and the ratio of the quantity of the compressed gas which flows the heat exchanger 35 from the compressor 24, and the quantity of the compressed gas which bypasses this heat exchanger 35 can be suitably adjusted now. It may replace with the flow control valves 34 and 36, and a three way selector valve may be used. And when the temperature up of natural gas according to the heat exchanger 27 by **** composition is insufficient, the temperature up of natural gas becomes possible with the heat exchanger 35 further.
[0010]Drawing 3 has attached the same number mutually about the portion which is common in the compression equipment 21 which shows the compression equipment 41 concerning a 3rd embodiment of this invention, and is shown in drawing 1 in drawing 3. In this compression equipment 41, the channel of the secondary of the evaporator 3 is branched to two channels, Form the expansion turbine 4, the heat exchanger 27, and the pressure control valve 42 in one channel, form the expansion turbine 4A, the heat exchanger 27, and the same heat exchanger 27A in the channel of another side, the channel of the secondarys of the flow control valve 42 and the heat exchanger 27A is made to join, and it has formed. Pass the heat exchanger 27 and the discharge passage 45 of the compressor 44 driven by the motor 43, [the heat exchanger 27A] By passing the discharge passage 48 of the compressor 47 driven by the motor 46, and carrying out heat exchange between compressed gas and natural gas, the rise in heat of the natural gas is carried out, and the temperature drop of the compressed gas is carried out. This drawing 3 shows the example it was made to drive the dynamos 49 and 49A by the expansion turbines 4 and 4A.
[0011]In the case of the example shown here, the expansion ratio in the expansion turbines 4 and 4A is changed. If the expansion ratio in the expansion turbine 4A is made into the value generally adopted conventionally so that the outlet temperature of the expansion turbine 4A may be about -30 **, the compressed gas spewed forth from the compressor 47 will be about -10 ** with the heat exchanger 27A, and can be used as an object for freezing. On the other hand, if the expansion ratio in the expansion turbine 4 is made small so that the discharge temperature of the expansion turbine 4 may be about 0 **, the compressed gas spewed forth from the compressor 44 will be about 10 ** with

the heat exchanger 27, and can be used as an object for air conditioning. The pressure control valve 42 is for carrying out pressure control so that the expansion turbine 4 can operate in the state of rating. The variable nozzle for [at least] flow regulation to either of the expansion turbines 4 and 4A may be provided. By this, when the flow of natural gas changes, with the above-mentioned variable nozzle, While being able to keep stable the flow of the natural gas by the side of suction of the above-mentioned expansion turbine now and being able to maintain the gas expansion ratio always near rated specification, it becomes possible to stabilize the temperature of natural gas after being breathed out.
[0012]Drawing 4 has attached the same number mutually about the portion which is common in the compression equipment 41 which shows the compression equipment 51 concerning a 4th embodiment of this invention, and is shown in drawing 3 in drawing 4. In this compression equipment 51, the expansion turbine 4 of the 1st step, the heat exchanger 27, the expansion turbine 4B of the 2nd step, the heat exchanger 27B, and the pressure control valve 42 are formed in the channel of the secondary of the evaporator 3. The discharge passage 55 linked to the discharge mouth 54 of the compressor 53 driven by the motor 52 is made to result in the heat exchanger 27B, It branches from the portion of the discharge passage 55 which came out from here, and through the heat exchanger 27, the branching channel 56 which joins the portion of the discharge passage 55 of the primary side of the heat exchanger 27B is formed, and it has formed. This drawing 4 has shown the example it was made to drive the dynamos 49 and 57 by the expansion turbines 4 and 4B.
[0013]Thus, the cooling capacity by this compressed gas can be raised by re-cooling a part of compressed gas spewed forth from the compressor 53. In order to adjust the flow of gas branched to the branching channel 56, the method change-over valve of three may be provided in a branching part, or a flow control valve may be provided in a branching channel. As mentioned above, also in the 2nd - a 4th embodiment, sea water supply equipment, the cooling system using this, etc. are not needed, but it has simple composition. Each embodiment can be installed now also in the reason which does not need sea water, and the inland distant from the sea. Although the number of expansion turbines is 1 or two sets and the number of compressors showed two sets of 1 or things by each embodiment mentioned above, this invention does not limit these number at all.
[0014]
[Effect of the Invention]According to this invention, the heat exchanger which cools the above-mentioned compressed gas using the cold energy produced at the time of evaporation of a low temperature liquefied gas is interposed in the channel of compressed gas, and it has formed in it so that more clearly than the above explanation. For this reason, forming the supply plant of the low meniscus point gas which becomes carrying out temperature up of the evaporated low meniscus point gas from simpler composition -- sea water supply equipment becomes unnecessary -- generates effects, such as becoming possible.